



PHYSICOCHEMICAL ANALYSIS AND MINERALS CONTENT OF TWO VARIETIES OF *HIBISCUS SABDARIFFA* SEEDS FROM BENIN

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ABSTRACT

Hibiscus sabdariffa Linn. (Malvales) varieties are widely used in sub-Saharan Africa as plant food and in folk medicine. Several studies have focused on the variety *sabdariffa* of different countries; but the one that from Benin has not been investigated. The present study has evaluated some physicochemical characteristics and mineral content of two varieties of *Hibiscus sabdariffa* seeds from Benin. The Physicochemical analysis result obtained were as follows: 96.12 ± 0.17 and $96.19 \pm 0.05\%$ of dry matter, 5.40 ± 0.40 and $4.94 \pm 0.10\%$ of ash, 4.69 ± 0.07 and $2.31 \pm 0.02\%$ of crude proteins, 0.71 ± 0.03 and 1.09 ± 0.05 mg/ml of vitamin C respectively for *sabdariffa* and *altissima* varieties seeds. Spectroscopy used for mineral analysis revealed in the two seeds varieties: 43.10 ± 0.003 and $71.68 \pm 0.002\%$ of manganese, 12.91 ± 0.002 and 9.89 ± 0.17 mg/kg of copper, 128.54 ± 0.40 and 85.08 ± 0.12 mg/kg of iron, 44.47 ± 0.60 and 16.24 ± 0.06 mg/kg nickel, 231.53 ± 0.2 and 440.51 ± 0.58 mg/kg sodium, 61.44 ± 0.57 and 45.94 ± 0.04 mg/kg zinc. Following the above results, *Hibiscus sabdariffa* variety *altissima* and *Hibiscus sabdariffa* variety *sabdariffa* seeds can be used as food supplement or additive to resolve or prevent nutrients deficiency consequences.

Keywords : *Hibiscus sabdariffa*, variety, physicochemical characteristics, nutrients.

INTRODUCTION

The use of plants by humans for various purposes date to very long time and is as old as the history of humanity [1]. Indeed, the rich and diverse African floras, plant resources including ornamental and medicinal plants occupy a large place and play an important role in the African economy [2]. Thus more than 500 species of *Hibiscus* are known in the world. These plants are found in tropical and subtropical areas [3]. Most species are used as ornamentals except for *sabdariffa* species, among which two varieties of *Hibiscus sabdariffa* have been identified: *sabdariffa* variety which calyxes are light or dark red and *altissima* variety with green calyxes. Previous studies have evaluated the variety *sabdariffa* calyxes and revealed their anthocyanins content, their antioxidants, antiseptic, aphrodisiac anti-inflammatory, anti cancer properties [4],[5].

Regarding the seeds, some studies have focused on physicochemical characteristics of *sabdariffa* variety originated from Cote d'Ivoire and Senegal [6]. In Benin, "Yanyanku" and "Ikpuru" are two

fermented products based on *Hibiscus sabdariffa* seeds, these products are used to enhance the flavor of many dishes including soups and sauces [7]. But most of *Hibiscus sabdariffa* consumed in Benin is imported from Senegal and Mali, in recent years some farms appear in Benin. To date there is no work on the characterization of seeds of *Hibiscus sabdariffa* from Benin [8]. The aim of the current study is to determine some characteristics and minerals content of these seeds for their valorization in nutrition and as well as in medicine.

MATERIALS AND METHODS

Plant material: *Hibiscus sabdariffa* variety *sabdariffa* and *Hibiscus sabdariffa* variety *altissima* seeds were harvested September 2014 from Lobogo area of Bopa region in, Mono a department of Benin.

Physicochemical analysis: Using the powdered seed, the dry matter content was determined according to the method AOAC (1984)[9]. Ash content was obtained after calcination in the oven at 290 to 600°C following the method AOAC [9].

Vitamin C content: Vitamin C contained in analyzed samples was determined by titration with thiosulfate and diiodine in the presence of starch [10].

Proteins content:The crude protein content was determined from nitrogen content, which was determined using Kjeldahl method [11].

Mineralscontent: Seeds of the two varieties of *Hibiscus sabdariffa* were reduced to ashes after cremation; ashes were digested for 30 min in a mixture of nitric acid 1M and hydrochloric acid 3N. The filtrates were used to determine minerals content, following NF EN 14082 [12] and ISO 15587-2 [13] methods, using flame atomic absorption spectroscopy (VARIANT with spectra A110 software).

RESULT AND DISCUSSION

Dry matter, ash, vitamin C and protein contents of the two *Hibiscus sabdariffa* varieties seeds are presented in Table 1. Dry matter content of *sabdariffa* variety is substantially equal to that of *altissima* variety; so the same conclusion is done for the moisture contents (3.88 – 3.81% respectively). Those water contents are lower than 7%, the value recommended by the Codex Alimentarius [14] and the value (5.85 to 7.62%) recommended by the National Institute of Agricultural Research of Benin [15]. Regarding ash content, it is relatively high in the *sabdariffa* variety, but the values obtained with the two varieties are higher than what is recommended by the Benin standard NB 01.03.004 (2.5%) [16] and the Food and Agriculture Organization (4.8%) [17].

Table 1: Physicochemical analysis, Vitamin C and Proteins contents of *Hibiscus sabdariffa* seeds

Varieties	Dry matter (%)	Ash (%)	Vitamin C (mg/ml)	Protein (%)
<i>Sabdariffa</i>	96.12 ± 0.17	5.4 ± 0.40	0.71 ± 0.03	4.69 ± 0.07
<i>Altissima</i>	96.19 ± 0.05	4.94 ± 0.10	1.09 ± 0.05	2.31 ± 0.02

The Table.1 indicate that variety *altissima* seeds are rich in vitamin C than *sabdariffa* variety, while the most important protein content was found in the variety *sabdariffa*. Vitamin C (Ascorbic acid) is a water-soluble vitamin required in high amount, as its loss is frequent from body. It participates in

reversible oxidation reduction system [18]. Only calyces were studied by previous works, for their vitamin C content and any study has focused on *Altissima* variety seeds. These seeds because of their vitamin C content can be used as anti-oxidant sources. Protein content of the seeds decreased with the color of the variety, protein content of the variety *sabdariffa* is twice higher than that in *altissima* variety. It justifies its use in some African countries, for the manufacture of traditional condiments for cooking and fermentation [7], [19].

In previous works the most studied of *Hibiscus sabdariffa* was *sabdariffa* variety, only few work focused on the variety *altissima*. In India, a study on variety *sabdariffa* seeds shows 92-94% dry matter, 5.4% ash, 18-22% of crude protein [20]. In Malaysia the same varieties of seeds contains 91.02 % of dry matter, 7.5% ash and 33.5% of crude protein[21]. Ayssuwede [22] obtained with Senegal samples 89.9% of dry matter, 27.3% of crude protein and 10.7% of ash. Egypt and Lebanon samples contain respectively 90.75 and 94.68% of dry matter, 6.89 and 5.60% of ash, 31.2 and 28.67% of crude protein [23]. Cisse in a review work [24] on *sabdariffa* variety shows the following average contents: dry matter 80.7%, ash 5.9% and 26.2% of crude protein. Compare to previous works results; the content of protein obtained in the current work is very low.

Table 2: Minerals composition of the two varieties of *Hibiscus sabdariffa* seeds

Minerals	<i>Hibiscus sabdariffa</i> varieties	
	<i>Sabdariffa</i>	<i>Altissima</i>
Calcium (%)	0.93±0.04	0.86 ±0.05
Chromium (mg/Kg)	nd	nd
Potassium (%)	1.41 ± 0.002	1.26 ± 0.002
Cadmium (mg/Kg)	nd	nd
Sodium (mg/Kg)	231.53 ± 0.2	440.51 ±0, 58
Nitrogen (%)	0.75 ± 0.07	0.37 ± 0.02
Nickel (mg/Kg)	44.47 ± 0.6	16.24 ± 0.06
Phosphorus (%)	0.57 ± 0.03	0.54 ± 0.07
Zinc (mg/Kg)	61.44 ± 0, 57	45.94 ± 0.04
Iron (mg/Kg)	128.54 ± 0, 4	85.08 ± 0, 12
Manganese (mg/Kg)	43.10 ±0, 003	71.68 ± 0.002
Magnesium (%)	0.38 ± 0, 05	0.30 ± 0.02

Copper (mg /Kg)	12.91 ± 0.002	9.80 ± 0.17
Lead (mg/Kg)	nd	nd

nd = not determined

The different minerals contents in the two varieties of seeds are presented in Table 2. Variety *sabdariffa* seeds are richer in copper, iron, nickel and zinc whereas those of the variety *altissima* contain a high content of manganese and sodium. Phosphorus, potassium, calcium and magnesium are at substantially equal levels in the seeds of the two varieties studied. Cisse and al [24] in his synthesis work on *sabdariffa* variety seeds, has reported: 680 mg/100g of calcium and sodium, 420 mg/100g of magnesium, 1350 mg/100g of potassium, 5.9 mg/100g of zinc and 8.8 mg/100g of iron. Congo *sabdariffa* variety seeds contain: 647.0 mg/100g of calcium, 659.0mg/100g of sodium, 442.8mg/100g of magnesium, 1329mg/100g of potassium, and 510mg/100g of phosphorus [26]. Minerals values contents obtained in the current study are very low; geographical origin of plants, belonging to the same species can result different concentration of elements depending of soil features and environmental pollution [27]. Lead like the other elements of zinc, copper, iron, chromium and cadmium is generally the metal of great concern as well as being phytotoxic [28] but minerals are important for vital body functions such as acid base and water balance. A diet rich in potassium reduces the risk of hypertension [29], calcium and phosphorus are the minerals present in the largest quantity in the structure of the body and in the bones [18]. Copper is a trace element present in all tissues and is required for cellular respiration, pigment formation, and connective tissue strength [30]. This study showed cadmium, chromium and copper content of the seeds were lower than recommended by World Health Organization in raw plant materials: 0.3 mg/kg of cadmium, 2mg/kg of chromium and 20 mg/kg of Copper [27]. Zinc deficiency increases the production of free radicals and reactive oxygen species, which can result in increased oxidative damage cellmembranesit have antioxidant property [30],[31].Zinc is a mineral that is a component of more than 300 enzymes needed to repair wounds maintains fertility in adults and growth in children, synthesize protein, and helps cell reproduce[32]. Nickel is required in minute quantity for body as it mostly present in pancreas and hence plays an important role in production of insulin. But uptake of large amount of it results in lung cancer, birth defects, and heat disorder, most common ailment arising from nickel is allergic dermatitis [32]. Excess in iron causes siderosis and can lead to cirrhosis, while the deficit is the cause of iron deficiency anemia[33].Iron deficiency anemia has been associated with poor cognitive development and behavior problems [34]; Manganese is an essential trace element for normal growth and development for cellular homeostasis [35],it deficiency causes skin lesions and bone malformation [36].Sodium is an essential nutrient necessary for maintenance of plasma volume, acid-base balance and transmission of nerve impulses. Increased sodium consumption is associated with increased blood pressure. Lower sodium intake is also associated with a reduced risk of stroke and fatal coronary heart disease in adults [36]. The presence of these minerals in *Hibiscus sabdariffa* seeds (iron, zinc, nickel, manganese, vitamin C and protein) gives them an important place in animals and human feed and health.

CONCLUSION

Hibiscus sabdariffa variety *sabdariffa* seeds with their crude proteins iron and zinc content, *Hibiscus sabdariffa* variety *altissima* content in vitamin C and manganese. The both varieties of seeds can play important role in dietary of developing country population. A study on the most samples of *Hibiscus sabdariffa* varieties seeds come from another area of Benin is necessary.

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